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Nota di contenuto	3D Images of Materials Structures; Foreword; Contents; Preface; Conventions and Notation; 1 Introduction; 2 Preliminaries; 2.1 General Notation; 2.1.1 Points and Sets in Euclidean Spaces; 2.1.2 Curvatures; 2.1.3 Measures and Measurable Spaces; 2.2 Characteristics of Sets; 2.2.1 The Euler Number and the Integral of Gaussian Curvature; 2.2.2 The Mean Width and the Integral of the Mean Curvature; 2.2.3 Intrinsic Volumes of Convex Bodies; 2.2.4 Additive Extensions on the Convex Ring; 2.2.5 The Principal Kinematic Formulae of Integral Geometry; 2.3 Random Sets; 2.3.1 Definition of Random Sets 2.3.2 Characteristics of Random Closed Sets2.3.3 Random Point Fields; 2.3.4 Random Tessellations; 2.4 Fourier Analysis; 2.4.1 Measurable

Functions; 2.4.2 Fourier Transform; 2.4.3 Bochner's Theorem; 3 Lattices, Adjacency of Lattice Points, and Images; 3.1 Introduction; 3.2 Point Lattices, Digitizations and Pixel Configurations; 3.2.1 Homogeneous Lattices; 3.2.2 Digitization; 3.2.3 Pixel Configurations; 3.3 Adjacency and Euler Number; 3.3.1 Adjacency Systems; 3.3.2 Discretization of Sets with Respect to Adjacency; 3.3.3 Euler Number; 3.3.4 Complementarity; 3.3.5 Multi-grid Convergence
3.4 The Euler Number of Microstructure Constituents3.4.1 Counting Nodes in Open Foams; 3.4.2 Connectivity of the Fibres in Non-woven Materials; 3.5 Image Data; 3.5.1 The Inverse Lattice; 3.5.2 The Nyquist--Shannon Sampling Theorem; 3.6 Rendering; 3.6.1 Volume Rendering; 3.6.2 Surface Rendering; 4 Image Processing; 4.1 Fourier Transform of an Image; 4.1.1 The Discrete Fourier Transform of a Discrete One-Dimensional Signal; 4.1.2 Fast Fourier Transform; 4.1.3 Extensions to Higher Dimensions; 4.2 Filtering; 4.2.1 Morphological Transforms of Sets; 4.2.2 Linear Filters; 4.2.3 Morphological Filters
4.2.4 Rank Value Filters4.2.5 Diffusion Filters; 4.2.6 Geodesic Morphological Transforms; 4.2.7 Distance Transforms; 4.2.8 Skeletonization; 4.3 Segmentation; 4.3.1 Binarization; 4.3.2 Connectedness, Connected Components and Labelling; 4.3.3 Watershed Transform; 4.3.4 Further Segmentation Methods; 5 Measurement of Intrinsic Volumes and Related Quantities; 5.1 Introduction; 5.2 Intrinsic Volumes; 5.2.1 Section Lattices and Translation Lattices; 5.2.2 Measurement of Intrinsic Volumes; 5.2.3 Discretization of the Translative Integral; 5.2.4 Discretization of the Integral over all Subspaces
5.2.5 Shape Factors5.2.6 Edge Correction; 5.3 Intrinsic Volume Densities; 5.3.1 Estimation of Intrinsic Volume Densities for Macroscopically Homogeneous Random Sets; 5.3.2 Characterization of Anisotropy; 5.3.3 Mean Chord Length; 5.3.4 Structure Model Index; 5.3.5 Estimation of the Intrinsic Volume Densities for Macroscopically Homogeneous and Isotropic Random Sets; 5.3.6 Intrinsic Volume Densities of the Solid Matter of Two Natural Porous Structures; 5.4 Directional Analysis; 5.4.1 Inverse Cosine Transform; 5.4.2 Use of Pixel Configurations Carrying Directional Information
5.4.3 Gradient and Hessian Matrix

Sommario/riassunto

Taking and analyzing images of materials' microstructures is essential for quality control, choice and design of all kind of products. Today, the standard method still is to analyze 2D microscopy images. But, insight into the 3D geometry of the microstructure of materials and measuring its characteristics become more and more prerequisites in order to choose and design advanced materials according to desired product properties.This first book on processing and analysis of 3D images of materials structures describes how to develop and apply efficient and versatile tools for geometric analys